

The Gypsum Products Development Association (GPDA) comprises a permanent Secretariat and member companies, in the UK and the Republic of Ireland, all engaged in the manufacture of gypsum products.

The primary function of the GPDA is to develop and encourage the understanding of gypsum-based building products and systems and to pioneer new applications

for these products. It also has an ongoing commitment to advise on matters of environmental impact, energy conservation and health and safety, wherever gypsum based products are used.

The members promote the use of systems which maximise the conservation of energy and give a high priority to waste reduction and recycling initiatives.



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Sound Separation Acoustic Solutions using Gypsum Products



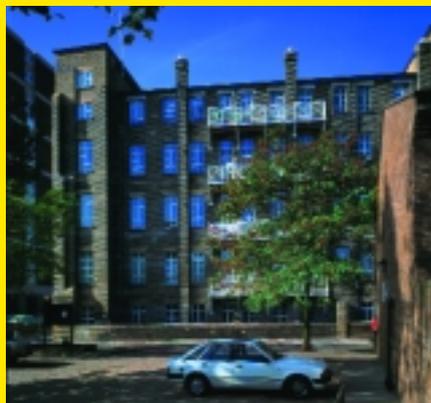
There is a growing awareness amongst building users and occupants of the value of good acoustic separation in improving the quality of the working environment, leisure facilities and the home. It is generally recognised that occupants are becoming more discerning with regard to the internal environment and the role that acoustics play within that.

In particular, the housing market offers a challenge to those working on new build as well as the upgrading, refurbishment or conversion of existing properties.



Modern living can be noisy: externally, traffic and street life all produce sound from which residential properties need to be appropriately insulated. We cannot control the day to day noise produced by neighbours, but we can prevent this from being intrusive.

Even within a dwelling modern life is increasingly able to produce high levels of sound from which other parts need to be insulated. Changing working lifestyles mean that the home will have to accommodate activities which will also require better acoustic performance. Furthermore, there is an increasing need for higher densities in urban developments, for which effective acoustic solutions will be required.



This document looks at the challenge faced by the designers and by the housing industry in particular to respond to the changing demands of building occupants. It shows the potential of gypsum products and systems to produce effective solutions in order for comfortable acoustic environments as they apply particularly to new and refurbished housing.

It looks at the issues in terms of the selection of the appropriate performance required, the different technical solutions available and the detailed issues



The Challenge



All building types need the acoustic performance of their internal spaces to be carefully considered. Unwanted noise from outside the building, from adjacent buildings and from other internal spaces can have a detrimental effect on the quality of the internal environment. The challenge for the designer is to choose an appropriate performance target for the walls, floors and ceilings which isolates or absorbs the noise so that the quality of the internal environment is attained.

A number of documents, in particular BSI's *Sound insulation and noise reduction for buildings*, (see references), provide guidance for the acoustic performance for different spaces in particular building types. These guidelines continue to change as occupants increasingly demand better acoustic performance.

Several questions should be asked when specifying acoustic performance:

- Is the guidance a minimum requirement?
- Does this differ from the optimum acoustic performance?
- Is there a marketing opportunity in providing enhanced acoustic performance?
- Should provision be made in anticipation of increased performance requirements or other changes in the way that the building may be used in the future?

The Challenge for Housing

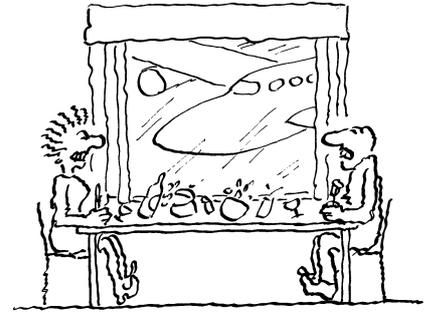


The housing sector provides one of the biggest opportunities for higher performance with the increasing demand for better acoustic environments.

Modern living has an increasing propensity to produce noise. UK Government projections estimate that there will be a need for almost 4 million new homes by the year 2021. There is now a move towards achieving higher densities and mixed use neighbourhoods, particularly in urban areas. To satisfy this demand successfully, designers may need to achieve a higher level of acoustic insulation, often using innovative acoustic solutions. Gypsum products will play a major role in new build, refurbishment and conversion to meet this requirement.

External Noise

Externally vehicles, such as cars and aircraft, present a persistent problem in many locations. Planning policy guidance note PPG24 'Planning & Noise' sets out the Government's policy and gives guidance to local authorities on the use of their planning powers to reduce adverse impact of noise. Local authorities must take the content of this Guidance



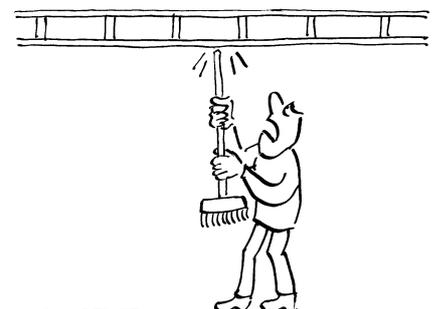
into account when preparing their development plans.

PPG24 introduces the concept of noise exposure categories for residential development, specifying the circumstances where noise is unlikely to be a determining factor and those where residential development should be refused. Intermediate categories deal with those situations where noise mitigation measures may make residential development acceptable.

Mixed use urban development often falls into these categories. PPG24 recommends that, in these circumstances, local authorities should specify that the building envelope should be constructed to provide an appropriate performance of sound attenuation against external noise. Local Authorities are increasingly adopting these policy stipulations as urban densities rise. Proven solutions, which can be tested on site, such as those achieved using GPDA members' products and systems will help designers to meet this challenge.

Between Dwellings

The UK Government has recognised that intrusive noise from neighbours is a critical issue and in response to this the Noise Act was introduced in 1996. This concentrates on controlling anti-social behaviour; if your neighbours make unreasonable amounts of noise, particularly at inappropriate times such as late at night, then they may be causing a 'statutory nuisance'. This sort of nuisance can be addressed legally through both the Noise Act or under Section 80 of the Environmental Protection Act 1990. However, not all noise from neighbours is covered under these regulations, indeed reasonable behaviour may cause unwelcome noise when sound insulation solutions are not optimised. The contribution of high performance separating walls and floors to alleviating the misery caused by noise pollution from all sources should not be underestimated.





Designers will have to consider not only acoustic separation between dwellings but also other areas which should be insulated such as common areas, lifts, walkways and mechanical plant. The increase in mixed-use development means the closer proximity of the home to commercial and retail outlets and therefore the noise associated with these. In these situations the minimum requirements for acoustic separation demanded by the Building Regulations may well be insufficient.

GPDA members anticipate that future Government legislation will demand far more stringent performance targets in terms of acoustic separation. Their research, in association with the Building Research Establishment, has identified that to achieve a comfortable acoustic environment in the home performance targets of 52-53 DnTw for standard separating walls and floors between dwellings are required. These targets can be readily achieved using well-detailed and constructed gypsum systems.

Within Dwellings

Even within the home there are challenges for the housebuilder and designer. There are no requirements for sound insulation within the Building Regulations for non-separating internal walls and floors. However, certain warranty schemes such as the Zurich Municipal and National House-Building Council and many housing association rules do require some

sound insulation performance.

In order to achieve a high quality acoustic environment in the home, designers should take account of a number of sound producers. The television is probably the most common producer of noise within the home, a family dwelling often includes television sets in the bedroom and the kitchen as well as the sitting room. Children's bedrooms often contain a whole host of noise producers, a multimedia computer system, a hi-fi system, maybe a musical instrument and, of course, the child itself.

Individual occupants may well have preferences, they may prefer the kitchen or the bathroom to be acoustically separated from the rest of their living accommodation. Homes which are designed to take account of these are more desirable and therefore more marketable.

Due to rapid changes in information technology we are also seeing enormous changes in working lifestyles. It has been predicted that in the near future up to one third of the workforce will constitute homeworkers. Homes to accommodate these changes in lifestyle could include a workplace which can be efficiently isolated from the normal activities of family life. This creates new challenges for designers, particularly when even the simple issue of separating impact sound between floors is often overlooked in housing schemes.



The Working Environment

The trend toward providing open environments for better communication and productivity (which also demands a particular level of acoustic performance), has not diminished the need to provide spaces for meetings, consultations and places where people can work quietly or in private. Examples where this requirement is greater than normal are legal and medical workplaces.

The Selection of Appropriate Systems

All members of the GPDA produce a range of plasterboards, including a special acoustic grade plasterboard which offers greater sound attenuation which can be applied where a particularly high performance is required. Acoustic plasterboards from GPDA members are always coloured blue. In most acoustic solutions the plasterboard is just one component of a system which comprises base or frame, fixings, sealants, insulating material and several offset linings.

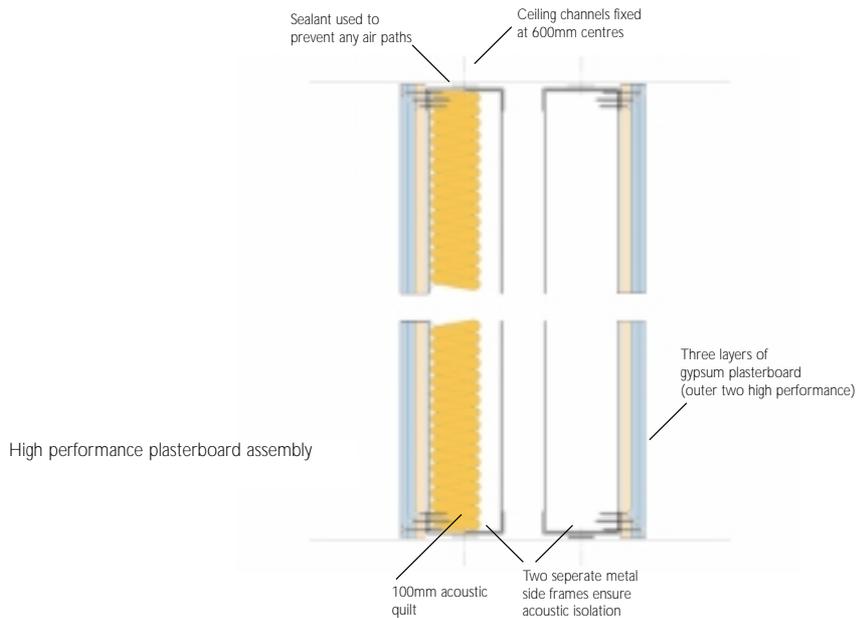
The GPDA members provide a number of tried and tested systems which deliver a variety of performance standards, from simple minimum requirements to high performance solutions for specialist applications.



Multiplex Cinema - Guildford

Multiplex Cinemas

In multiplex cinemas the importance of isolating one auditorium from another, as well as insulating performance spaces from external noise, is obvious. For this application, where a very high degree of sound insulation is required, high performance systems have been developed by members of the GPDA. These systems give exceptionally high levels of sound separation without sacrificing the flexibility of application and economy in terms of both cost and programme. The acoustic separation provided by the twin frame system shown right is R_{W76dB} .

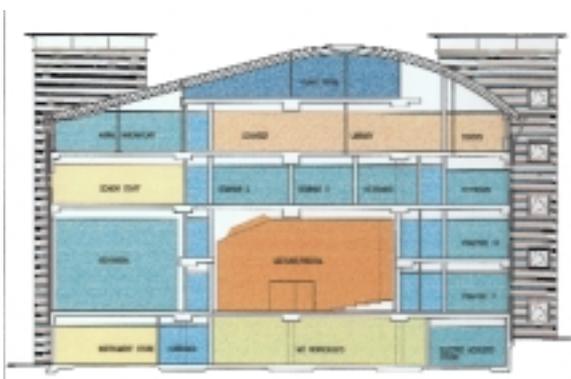


Buildings for Music

GPDA members technical departments often work with designers and acousticians on projects where very particular acoustic conditions are to be achieved such as buildings for musical performances. As well as the obvious requirement for a high quality acoustic environment in performance areas, where special plasters and plasterboards are used to modify the quality of sound, buildings such as opera houses and classical music venues often contain a number of other spaces which need successfully isolating from one another. These may include practice rooms for musicians, dressing rooms for performers, office accommodation for administrative staff and refreshment areas for members of the public.



Leeds College of Music - Building Design Partnership



Leeds College of Music - Cross Section

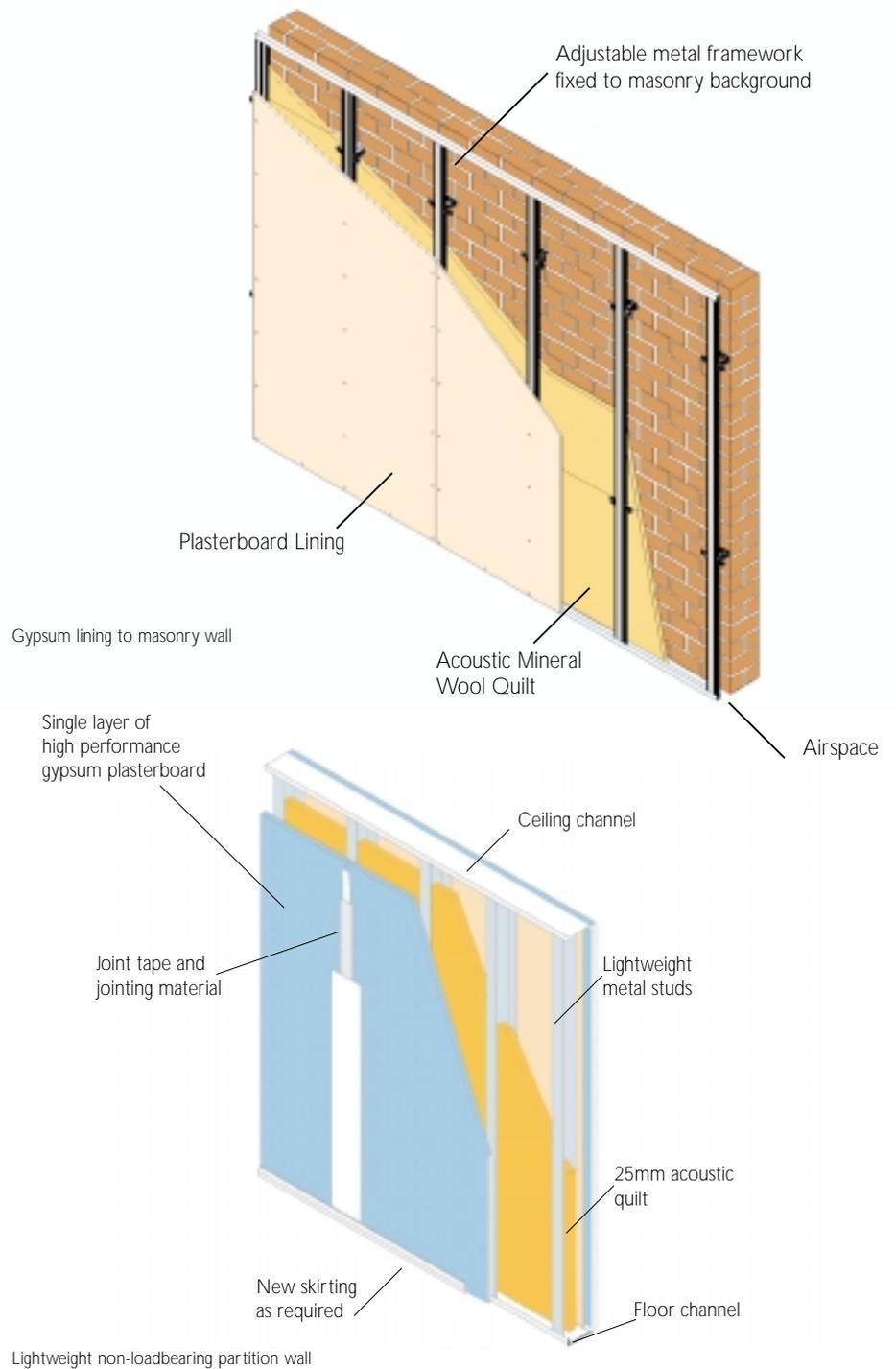
The Selection of Appropriate Systems for Housing

Gypsum products provide the key to the achievement of excellent acoustic performance in housing. Solutions can be found for both new construction and upgrades of existing dwellings.

Masonry, whose performance is dependent on its mass and homogeneity only. The use of plasterboard and mineral wool plasterboard laminates applied directly on a proprietary lining system provides varied options to improve acoustic performance.

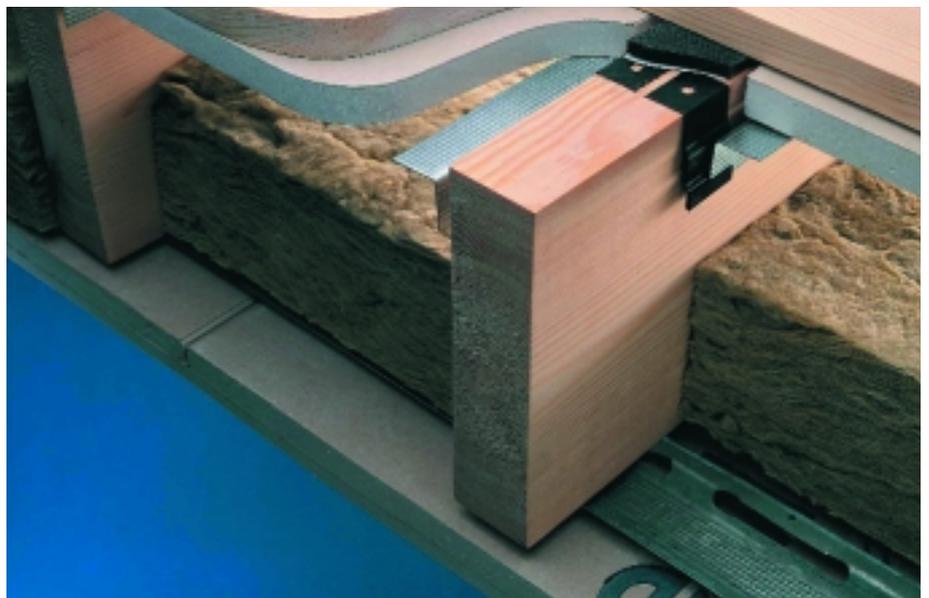
Frame Construction, in both timber frame and the increasingly specified steel frame construction, gypsum systems can be used as linings to external walls, separating walls and separating floors. In this instance the acoustic performance is dependent on the degree of isolation of the two spaces where the separation of the frame, the insulating material and the type and thickness of the gypsum linings all play a part in achieving good acoustic performance.

In both the above housing types, gypsum systems play a major role in both load bearing and non load bearing internal non separating walls and the range of systems available provides an opportunity for achieving the appropriate performance.



Floors

Gypsum plasterboard can also be used as a sub-base for the floating layer of an acoustic floor and as a ceiling lining on the underside where separating floors are required.



Gypsum plasterboard as a component of a separating floor

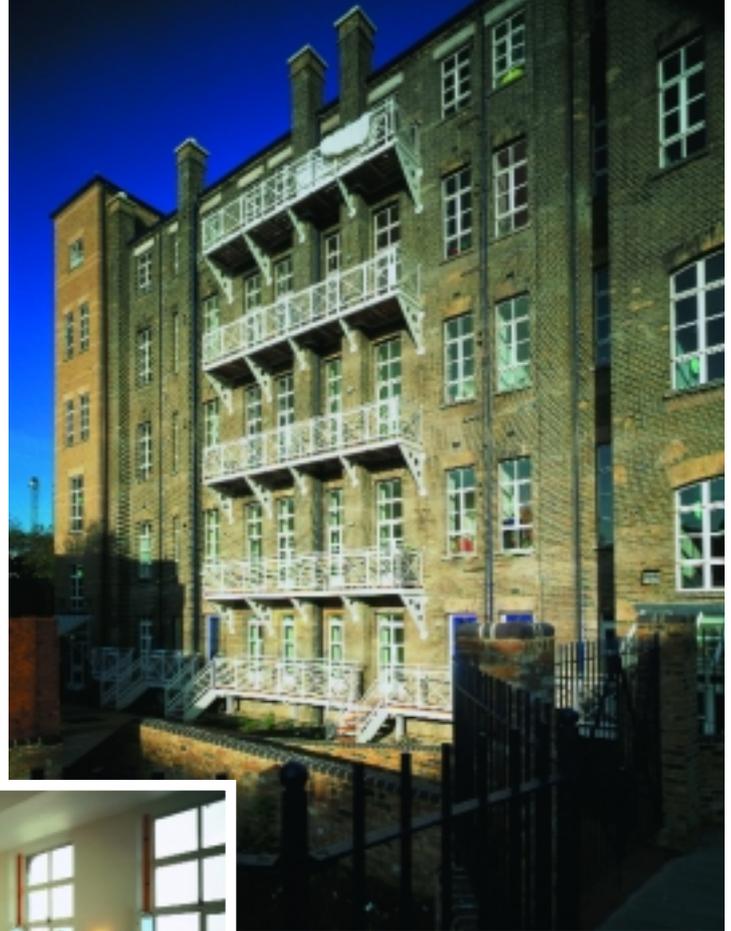
Case studies

Raines Mansions – Wapping, London

This project involved the conversion of a derelict five-storey building, originally a workhouse and then a Victorian hospital into twenty self-contained flats and maisonettes. The work was funded by the DOE Homeless Initiative and LBTH Wapping Neighbourhood and both the budget and contract period for the works were tight.

The planning of the flats to achieve the most effective use of the floor space dictated the need for lightweight party walls for both fire and sound insulation, the typically slim profile of gypsum plasterboard was an obvious choice to meet this requirement. The single aspect flats were designed to take advantage of the existing generous storey heights and fenestration. By detailing a ceiling which sloped sharply away from the balconied windows the architect was able to flood the apartments with natural light and at the same time attain a more domestic scale for the living accommodation. A gypsum ceiling system was specified for this, the architect was attracted by its flexibility, ease of construction and high performance in terms of fire safety and acoustic separation.

An extremely high quality finish was achieved using gypsum products for both separating walls and floors. Acoustic performance was tested on site and found to be well above that required by the Building Regulations. As well as being within budget the contract was finished on time with the use of plasterboard flooring and walling systems contributing greatly to the fast track nature of the works.

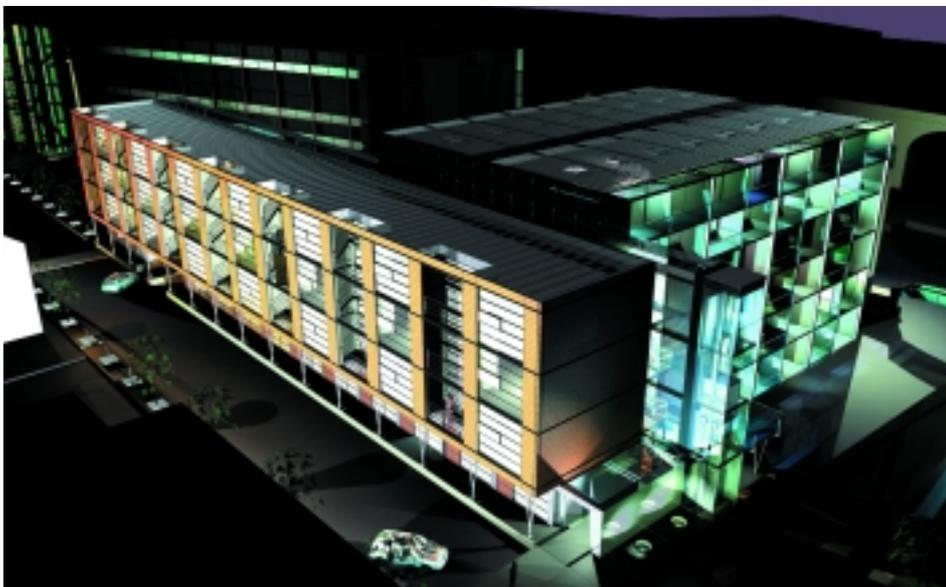


Raines Mansions - Interior



Raines Mansions - Exterior

Architect: Architype



Britannia Basin - Computer model

Britannia Basin, Manchester

The developer Urban Splash is converting two existing industrial buildings, Britannia Mills and Box Works, into 300 residential and commercial units. These will be linked by a new mixed-use block, Timber Wharf, the design of which was the subject of a high profile architecture competition.

The specification for both new construction and conversion of existing structures is demanding in respect of acoustic performance. It was important that the apartments achieved a high degree of

sound separation from each other and in some instances residences are directly situated over bars, business premises and nightclubs. In the existing buildings dry construction assemblies offer great advantages of imposing less weight and the avoidance of wet trade operations. Where the existing floors are continuous below party walls there is care in detailing so that flanking transmission does not downgrade the separation of the wall assembly.

A further challenge is reducing sound transmission through a framed building, where discontinuity detailing for the floors plays a key role. Floors can



Britannia Basin - Interior

deflect in mid span, so the correct use of deflection head details in partitioning ensures that sound insulation is maintained.

The new building maximises the use of prefabricated components. Apartment interiors will contrast the exposed main walls with the clean lines of dry construction interior walls. Where these meet the main walls, they are on the edge of the isolated floor screed and hence isolation has to be carefully fixed to the isolated floor screed, so that the resilient layer is not compromised by over long fixings into the main floor slab.

The bathroom and kitchen areas include mechanical extract systems connected into riser ducts of matching dry construction. Adequate containment of these vertical shafts along with the enclosures to the refuse chutes using gypsum products ensure privacy between floor levels.

Achieving Acoustic Performance – Industry Initiatives

The GPDA members are currently working with the Building Research Establishment on the 'Quiet Homes' project which will set standards for materials, design and workmanship to achieve good acoustic insulation for 21st century homes.

A manual 'Quiet Homes: a guide to good practice and reducing the risk of poor sound insulation between dwellings' has been produced in response to industry experience which shows that, despite the wide availability of Approved Document E, construction faults continue to appear which reduce the full potential of sound insulation solutions in the housebuilding industry. The manual is split into two sections giving advice for those working on both masonry and timber framed construction.

Specification

After extensive research, the Quiet Homes Group found that as well as sometimes misinterpreting the guidelines set out in the Approved Documents, designers found that the documents did not give detailed answers to all their questions on achieving good sound insulation.

The guide addresses this need by giving more detailed advice than that given in the Approved Document, particularly where research has shown that confusion arises. It gives guidance on good practice for achieving a high level of sound insulation, with advice aimed at both designers and tradesmen working on site. It deals with complex details for each element identified in the Approved Documents. Finally it includes checklists that can be copied and used by site supervisors to easily check that good practice is adhered to on a project.

In addition to the principles of mass and isolation as the governing factors in achieving good sound insulation, it particularly emphasises the importance of air tightness.

The Quiet Homes Guide is an excellent reference document for traditional construction types. Where innovative construction is proposed it is recommended that designers make use of the

technical advice provided by all of the GPDA members.

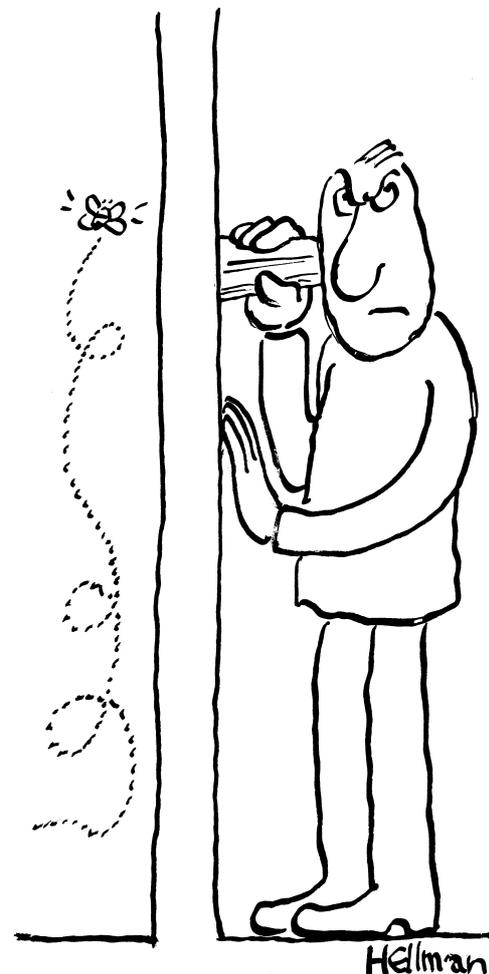
Members systems are subjected to impartial laboratory-based testing and can also be tested on site by means of mobile testing units.

Detailing and Workmanship

While drywall systems are simple to install and do not require specialist skills, acoustic performance can only be achieved when good practice is observed on site.

Some particular points to be aware of:

- Sealing of potential air paths with acoustic sealant is particularly important to make a good perimeter seal combined with good detailing where the wall interfaces with the structure.
- Good detailing is especially important to avoid flanking transmission. Where possible partitions should be run to the original structure at head and foot, particularly when a suspended ceiling has been specified. It should be noted that in practice, flanking through the associated structure often dominates the acoustic performance, unless carefully considered at the design stage. Experience shows that on site airborne sound test results are generally 6dB lower than laboratory results.
- Use high performance plasterboards.
- Penetrations should be avoided where sound insulation is important, consider using surface mounted services, and where possible avoid back to back electrical outlets.
- Acoustic sealant should be specified around switch boxes, door linings etc.
- All GPDA members offer accredited training courses on the application of acoustic partitioning and flooring systems at their dedicated training centres. All members also produce excellent technical literature and have dedicated technical staff ready to answer questions on specification, detailing and workmanship.



References & Further Reading

The Building Regulations for the UK and the Republic of Ireland set out requirements for sound insulation between dwellings.

PPG 24 Planning Policy Guidance 'Planning & Noise, DOE 1994. Gives guidance to local authorities on the use of their planning powers to minimise the adverse impact of noise.

BS 8233: 1999, Sound insulation and noise reduction for buildings, BSI London 1999 - A Code of Practice.

BRE/CIRIA Sound Control for Homes, BR 238 London HMSO, 1993 CIRIA Report 127, London, CIRIA 1993

Quiet Homes: A guide to good practice and reduction of poor sound insulation between dwellings. BRE Report 358

BRE, Improving Sound Insulation Good Repair Guide 22 Parts 1 & 2. BRE 1999. These guides show how to diagnose where sound is penetrating and give remedial solutions to acoustic problems.

BRE Digests

293: Improving the sound insulation of separating walls and floors
333: Sound insulation of separating walls and floors Part 1: Walls
334: Sound insulation of separating walls and floors Part 2: Floors



Acoustic testing